

REMARKS

In accordance with the foregoing, the specification has been amended. Claims 1 - 8 are pending and under consideration.

As seen in the Proposed Amendment, the Applicants have amended a typographical error in the present specification, as described below.

The "meld molding" at page 52, line 5 of the present specification has been amended to read --melt molding--. This amendment is merely a correction of an inadvertent typographical error.

No new matter has been introduced by the amendment.

/I/ The state of the art and the features and advantages of the present invention:

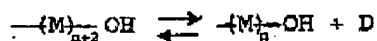
(I-1) Background information:

Before specifically discussing the rejection of the claims, it is believed that the following background information should be considered in order to shed a proper light on the development of the present invention and the advantageous features thereof. As discussed in the specification under "Prior Art", a polytrimethylene terephthalate (PTT) produced by a conventional melt polymerization process has a problem in that the PTT contains a large amount of by-produced oligomers. Specifically, the conventional PTT contains oligomers in an amount of from 2.5 to 3.5 % by weight, and about 90 % by weight of the oligomers are a cyclic dimer which is a cyclic

compound which is formed by a condensation of 2 terephthalic acid molecules. This cyclic dimer is disadvantageous in that it sublimates and is likely to bleed out from the PTT. Therefore, for example, when the conventional PTT is subjected to spinning, the cyclic dimer sublimates and is deposited around the spinning nozzle. The deposited cyclic dimer adheres to the resultant spun polymer (polymer fiber) which passes through the spinning nozzle, thereby causing the breakage or fuzzing of the polymer fiber.

Further, when the conventional PTT is subjected to injection molding, the cyclic dimer deposits on the inner surface of the mold (that is, a mold deposit occurs), so that the appearance and dimensional precision of the shaped article are spoiled.

The above-mentioned cyclic dimer is formed by the so-called "ring-linear chain equilibrium reaction" which occurs at the hydroxyl group-containing terminal portions of a PTT. Specifically, in a PTT resin, there is an equilibrium (i.e., a ring-linear chain equilibrium) between a cyclic dimer and a linear dimer unit (i.e., two consecutive trimethylene terephthalate molecules) at the hydroxyl group-containing terminal of a PTT, as shown in the following formula:



wherein M represents a trimethylene terephthalate recurring unit and D represents a cyclic dimer.

Therefore, even when the cyclic dimer is removed from the PTT by volatilization during the polymerization reaction, the cyclic dimer is immediately generated again in the same amount as that of the removed cyclic dimer, thereby causing the loss of the PTT. Thus, it was impossible to produce a PTT containing the unfavorable cyclic dimer in an amount reduced significantly. Thus, the yield of the PTT becomes inevitably low.

Further, as a method for producing a high molecular weight PTT which has an excellent heat stability, there has been proposed a method for producing a PTT by a solid-phase polymerization process (in which prepolymer pellets are subjected to a polymerization). In a solid-phase polymerization process, the polymerization is performed at low temperatures and, hence, the ring-linear chain equilibrium of the PTT can be displaced in the direction of the formation of the linear dimer unit (derived from the cyclic dimer) at the hydroxyl group-containing terminals of the PTT. For this reason, it has been reported that the solid-phase polymerization process is effective for reducing the cyclic dimer content of PTT.

However, as a result of the studies of the present inventors, it has been found that, the solid-phase polymerization process poses various problems, such as the problem that, even when a PTT having its cyclic dimer content reduced to less than 1 % by weight is produced by the solid-phase polymeriza-

tion process, the cyclic dimer is rapidly produced upon melting thereof during the melt-molding of the PTT, and the reduced cyclic dimer content of the PTT returns to the cyclic dimer content (about 2.5 to 3.5 % by weight) of the prepolymer prior to the solid-phase polymerization in which the hydroxyl group-containing terminal portions are at the ring-linear chain equilibrium state.

For solving such problems accompanying the solid-phase polymerization process, there have been proposed various, improved melt polymerization processes.

However, conventionally, the problems of the prior art have not yet been satisfactorily solved.

In this situation, the present inventors have made extensive and intensive studies with a view toward solving the above-mentioned problems accompanying the prior art, and developing a polytrimethylene terephthalate (PTT) resin which can be used as a raw material for stably producing, on a commercial scale, a shaped article having high quality (i.e., shaped article which has excellent strength and color, and which is free from the bleeding of the cyclic dimer to the surface of the shaped article, so that the shaped article is suitable for coating with a coating composition or adhesive agent and exhibits excellent adhesion property). As a result, it has unexpectedly been found that, when a crude PTT resin (used as a raw material for the PTT resin of a final PTT resin

having advantageously low cyclic dimer content) is produced by a specific method (e.g., a method using a specific catalyst), it becomes possible to obtain a crude PTT resin which is *capable of suppressing the formation of the cyclic dimer even when the crude PTT resin is melted*. (The claims do not require any particular catalyst.) Further, by removing the cyclic dimer from the obtained crude resin in a molten form, it becomes possible to obtain a PTT resin having an intrinsic viscosity $[\eta]$ of from 0.6 to 4 dl/g, a molecular weight distribution (Mw/Mn) *as narrow as* from 2 to 2.7, a cyclic dimer content *as small as* not greater than 2 % by weight, and a psychometric lightness L-value of from 70 to 100 and a psychometric chroma b*-value of from -5 to 25. By using such a PTT resin, it becomes possible to produce an excellent shaped article stably on a commercial scale. Specifically, the shaped article produced using the polytrimethylene terephthalate resin of the present invention has *high strength and excellent color*. Further, the shaped article is *free from the bleeding of the cyclic dimer* to the surface of the shaped article, so that the shaped article is *suitable for coating* with a coating composition or adhesive agent and exhibits *excellent adhesion property*. The present invention has been completed, based on these novel findings.

It is an object of the present invention to provide a polytrimethylene terephthalate resin which can be used for

stably producing, on a commercial scale, a shaped article which has high strength and excellent color, and which is free from the bleeding of the cyclic dimer to the surface of the shaped article, so that the shaped article is suitable for coating with a coating composition or adhesive agent and exhibits excellent adhesion property.

Claim 1 of the present application is essentially directed to a polytrimethylene terephthalate resin comprising:

60 to 100 mole % of (a) trimethylene terephthalate recurring units, and

0 to 40 mole % of (b) at least one monomer unit obtained from a comonomer copolymerizable with at least one of the monomers used for forming the trimethylene terephthalate recurring units,

the total molar amount of (a) monomer units and (b) monomer units being 100 mole %,

the polytrimethylene terephthalate resin having the following characteristics (A) to (D):

(A) an intrinsic viscosity $[\eta]$ of from 0.6 to 4 dl/g;

(B) a molecular weight distribution (M_w/M_n) of from 2 to 2.7;

(C) a cyclic dimer content of not greater than 2 % by weight, the cyclic dimer being represented by formula (1); and

(D) a psychometric lightness L-value of from 70 to 100 and a psychometric chroma b^* -value of from -5 to 25.

Claim 3 of the present application is essentially directed to a method for producing the polytrimethylene terephthalate resin of the present invention, which comprises:

(1) providing a crude trimethylene terephthalate resin in a molten form, said crude trimethylene terephthalate resin comprising:

60 to 100 mole % of (a) trimethylene terephthalate recurring units, and

0 to 40 mole % of (b) at least one monomer unit obtained from a comonomer copolymerizable with at least one of the monomers used for forming the trimethylene terephthalate recurring units,

the total molar amount of (a) monomer units and (b) monomer units being 100 mole %,

said crude trimethylene terephthalate resin further comprising a cyclic dimer of formula (1),

said crude trimethylene terephthalate resin having an intrinsic viscosity $[\eta]$ of from 0.2 to 4 dl/g and a cyclic dimer formation index (E) of less than 0.066, said cyclic dimer formation index (E) being defined by formula (3); and

(2) removing, from said crude polytrimethylene terephthalate resin in a molten form, 0.5 % by weight or more, based on the weight of said crude polytrimethylene terephthalate resin, of said cyclic dimer, by volatilization under reduced pressure.

(I-2) Observations on the **novalty and non-obviousness** of the present invention:

(I-2-i)

The method of **claim 3** of the present application (for producing the polytrimethylene terephthalate resin of the present invention) is not disclosed in any of the prior art documents.

The polytrimethylene terephthalate resin of **claim 1** of the present application is not disclosed in any of the prior art documents and cannot be obtained by the conventional methods.

More specifically, as seen from the explanations of item (I-1) above, the polytrimethylene terephthalate resin of the present invention cannot be obtained by any of the conventional methods, i.e., the conventional melt polymerization processes and the solid-phase polymerization processes, and a combination of these processes.

In step (2) of the method of **claim 3** of the present application, the cyclic dimer is removed from the crude polytrimethylene terephthalate resin **in a molten form**. Therefore, needless to say, any solid-phase polymerization process can not fall in the definition of the method of **claim 3** of the present application.

With respect especially to the problems of the conventional technologies, i.e., the conventional melt polymeriza-

tion processes and the solid-phase polymerization processes as well as the conventional polytrimethylene terephthalate (PTT) produced by the prior art processes, attention is drawn to the following detailed explanations of the present specification:

"A PTT produced by a conventional melt polymerization process has a problem in that the PTT contains a large amount of by-produced oligomers. Specifically, the conventional PTT contains oligomers in an amount of from 2.5 to 3.5 % by weight, and about 90 % by weight of the oligomers are a cyclic dimer which is a cyclic compound which is formed by a condensation of 2 terephthalic acid molecules. This cyclic dimer is disadvantageous in that it sublimates and is likely to bleed out from the PTT. Therefore, for example, when the conventional PTT is subjected to spinning, the cyclic dimer sublimates and is deposited around the spinning nozzle. The deposited cyclic dimer adheres to the resultant spun polymer (polymer fiber) which passes through the spinning nozzle, thereby causing the breakage or fuzzing of the polymer fiber.

Further, when the conventional PTT is subjected to injection molding, the cyclic dimer deposits on the inner surface of the mold (that is, a mold deposit occurs), so that the appearance and dimensional precision of the shaped article are spoiled. Further, the cyclic dimer bleeds out on the surface of the shaped article, thereby lowering not only the coating performance in the coating process using a coating composition or an adhesive agent, but also the adhesion property. Further-

more, during the production of a PTT by a conventional melt polymerization process, the cyclic dimer volatilizes from the polymer and deposits on the inner wall of the conduit provided in the production system used, thereby causing the clogging of the conduit."

(emphasis added) (see page 7, line 16 to page 8, line 20 of the present specification);

"In a solid-phase polymerization process, the polymerization is performed at low temperatures and, hence, For this reason, it has been reported that the solid-phase polymerization process is effective for reducing the cyclic dimer content of PTT.

However, as a result of the studies of the present inventors, it has been found that, even when a PTT having its cyclic dimer content reduced to less than 1 % by weight is produced by the solid-phase polymerization process, the cyclic dimer is rapidly produced upon melting thereof during the melt-molding of the PTT, and the reduced cyclic dimer content of the PTT returns to the cyclic dimer content (about 2.5 to 3.5 % by weight) of the prepolymer prior to the solid-phase polymerization in which the hydroxyl group-containing terminal portions are at the ring-linear chain equilibrium state. Therefore, when a PTT produced by the solid-phase polymerization process is used for producing a melt-molded product (e.g., a fiber, a film or an injection-molded product), the above-mentioned problems caused by the cyclic dimer cannot be avoided.

Further, the solid-phase polymerization is advanced by removing trimethylene glycol (hereinafter, referred to as "TMG") from the surface of the PTT prepolymer pellets. Therefore, the polymerization degree varies depending on the size and shape of the pellets, and also varies depending on the position in the pellets. Therefore, the PTT obtained by this method is markedly non-uniform with respect to the polymerization degree (i.e., the PTT has a broad molecular weight distribution). Further, in the solid-phase polymerization, the solid prepolymer pellets get rubbed with one another over a long period of time, thereby generating polymer powder which becomes a loss. The presence of the polymer powder in the spinning process causes breakage or fuzzing of polymer fibers. For removing the polymer powder, an additional step therefor becomes necessary. Further, the solid-phase polymerization should be performed after the production of the prepolymer by the melt polymerization and the like, and thus, the entire process for producing a PTT becomes complicated and costly."

(emphasis added) (see page 10, line 12 to page 12, line 8 of the present specification);

"When a PTT resin is produced by the solid-phase polymerization, the resin produced exhibits a high polymerization degree. However, in the solid-phase polymerization, the polymerization degree varies depending on the reaction site in the pellets (i.e., whether the reaction site is at an inner por-

tion or outer portion of the pellets), and also varies depending on the size and shape of the pellets, so that it is very difficult to obtain a polymer having a narrow molecular weight distribution. By the method of the present invention (described below), it has, for the first time, become possible to produce a PTT resin which can be suitably used for the commercial scale production of the above-mentioned extrusion-molded article."

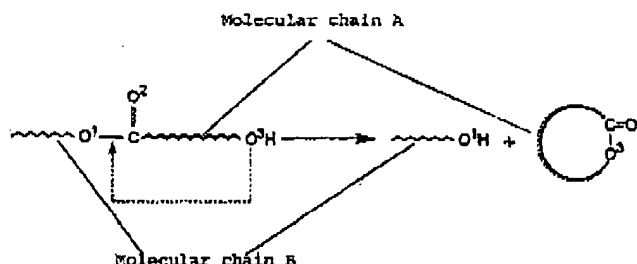
(emphasis added) (see page 41, line 15 to page 42, line 4 of the present specification); and

"As mentioned above, in the polymerization reaction system for producing a PTT resin, there is a ring-linear chain equilibrium between the cyclic dimer and the linear dimer unit at the hydroxyl group-containing terminal of a PTT resin. Therefore, when a PTT resin is produced by a conventional melt polymerization process, a part of the cyclic dimer contained in the PTT resin is volatilized during the polymerization; however, the cyclic dimer is immediately generated again in the same amount as that of the volatilized cyclic dimer, thereby causing the loss of the PTT. Thus, by the conventional melt polymerization process, it is impossible to produce a PTT containing the unfavorable cyclic dimer in a significantly reduced amount. Thus, the yield of the desired PTT becomes inevitably low. Further, as mentioned above, as a result of the studies of the present inventors, it has been found that, even when a PTT having its cyclic dimer content reduced to less than 1 % by weight is produced by the solid-phase polymerization process, the cyclic dimer is rapidly produced upon melting thereof during the melt-molding of the PTT, and the reduced cyclic

dimer content of the PTT returns to the cyclic dimer content (about 2.5 to 3.5 % by weight) of the pre-polymer prior to the solid-phase polymerization in which the hydroxyl group-containing terminal portions are at the ring-linear chain equilibrium state. (emphasis added) (see page 47, line 5 to page 48, line 6 of the present specification).

With respect especially to the most important findings made by the present inventors in the course of developing the present invention, attention is drawn to the following detailed explanations of the present specification:

"In this situation, the present inventors have made **detailed analysis** with respect to the properties and formation mechanism of the cyclic dimer. As a result, it has been found that the cyclic dimer is mainly formed by the so-called "back-biting reaction" which occurs at the hydroxyl group-containing terminal portions of the PTT resin, and that the formation rate of the cyclic dimer is influenced by the terminal hydroxyl group content of the PTT resin and the type of polymerization catalyst which is used in the production of the PTT. The "back-biting reaction" is an intramolecular reaction represented by the following formula:



wherein O¹, O² and O³ represents three different oxygen (O) atoms, respectively.

- 16 -

In the back-biting reaction, a hydroxyl group (positioned at the terminal of a PTT resin) and an ester group, which groups belong to the same polymer chain, react with each other, thereby causing the formation of a cyclic dimer and the subsequent re-formation of the terminal hydroxyl group. As apparent from the above formula, the back-biting reaction occurs at the hydroxyl group-containing terminal portions and, hence, the reaction rate of the back-biting reaction is proportional to the terminal hydroxyl group content of the PTT resin.

When a PTT produced by a conventional technique is maintained in a molten form at 260 °C, the PTT always shows substantially the same cyclic dimer content, namely, about 2.6 % by weight due to the above-mentioned ring-linear chain equilibrium. Further, even when a PTT having a cyclic dimer content of about 1.0 % by weight is produced by the solid-phase polymerization process, the cyclic dimer is rapidly produced when the PTT resin is melted and maintained at 260 °C, and the cyclic dimer content increases to about 2.6 % by weight within a period of from several minutes to several tens of minutes after the start of the melting of the resin and, then, the cyclic dimer content is maintained at about 2.6 % by weight.

The present inventors have found that, when a PTT resin has a high content of terminal hydroxyl group (which causes the back-biting reaction) (e.g., when the PTT resin has a low polymerization degree), the cyclic dimer formation rate of the

PTT resin becomes high, whereas, when a PTT resin has a low content of terminal hydroxyl group (e.g., when the PTT resin has a high polymerization degree or when the terminal hydroxyl groups of the PTT resin are blocked), the cyclic dimer formation rate of the PTT becomes low.

Further, the present inventors have also found that the cyclic dimer formation rate of a PTT resin is also greatly influenced by factors other than the terminal hydroxyl group content, for example, the type of polycondensation catalyst used in the production of the PTT resin, and that the cyclic dimer formation rate can be greatly suppressed by the use of a specific polycondensation catalyst and/or by highly purifying the PTT resin by a specific method.

Furthermore, in order to develop a technique for efficiently removing the cyclic dimer from a PTT resin by volatilization, the present inventors have isolated and purified the cyclic dimer, and evaluated the vapor pressure of the purified cyclic dimer at high temperatures under reduced pressure. As a result, the present inventors have succeeded in developing a method for stably producing, on a commercial scale, a PTT resin which has a low cyclic dimer content and is capable of suppressing the formation of the cyclic dimer even during the melt molding and, hence, can be advantageously used as a raw material for producing a high quality shaped article which is suitable for coating with a coating composition or

adhesive agent and exhibits excellent adhesion property. Conventionally, it has been considered that a PTT resin having a low cyclic dimer content cannot be obtained by only the melt polymerization process due to the above-mentioned ring-linear chain equilibrium. However, by the above-mentioned method developed by the present inventors, it has become possible to produce the above-mentioned excellent PTT resin (which has a low cyclic dimer content and is capable of *suppressing the formation of the cyclic dimer* during the melt molding) even when the polymerization for producing a PTT resin is performed by only the melt polymerization process (without using the solid-phase polymerization process)."

(emphasis added) (see page 48, line 7 to page 52, line 8 of the present specification).

Further, with respect especially to the great advantages of the method of claim 3 over the prior art techniques, attention is drawn to the following descriptions of the present specification:

"In the present invention, the cyclic dimer formation index (E) (= W/M) is used to evaluate the ability of the crude PTT resin to form the cyclic dimer in terms of a relationship between the cyclic dimer re-formation rate (W) and the terminal hydroxyl group content (M), wherein the cyclic dimer re-formation rate (W), as mentioned above, is influenced not only by the terminal hydroxyl group con-

tent, but also by other factors involved in the production of the PTT resin, such as the type of polymerization catalyst which is used in the production of the PTT resin, and the purity of the crude PTT resin. The present inventors have found that a crude PTT resin having a cyclic dimer formation index (E) of less than 0.066 can be obtained by the improvement of a polymerization catalyst or by highly purifying the crude resin, and that, by removing 0.5 % by weight or more (based on the weight of the crude resin) of the cyclic dimer from the crude resin in a molten form by volatilization under reduced pressure, the following advantages (1) to (3) can be achieved.

(1) Despite the use of the melt polymerization process for producing the PTT resin, the cyclic dimer content of the PTT resin can be significantly reduced.

(2) The amount of cyclic dimer volatilized during the production of the crude PTT resin can be greatly suppressed, thereby preventing the clogging of the conduit provided in the PTT resin production system, which clogging is caused by the deposition of the volatilized cyclic dimer on the inner wall of the conduit; and

(3) The PTT resin (having a low cyclic dimer content) produced by this method is capable of suppressing the formation of the cyclic dimer even when the resin is melted for the purpose of melt molding, so that the cyclic dimer content of the resin is unlikely to return to a value (approximately 2.5 to 3.5 % by weight) measured with respect to a PTT resin in which the hydroxyl group-containing terminal portions are at the ring-linear chain equilibrium. As a result, it has become possible to provide a PTT resin which not only has excellent mold-

ability, but also can be used for producing a shaped article which is suitable for coating with a coating composition or adhesive agent and exhibits excellent adhesion property. Such excellent effects cannot be obtained by a PTT resin which has its cyclic dimer content temporarily reduced by using the solid-phase polymerization process."

(emphasis added) (see page 57, line 18 to page 59, line 13 of the present specification).

Thus, as seen from the above, the present invention has novelty and non-obviousness over the conventional technologies, i.e., the conventional melt polymerization processes and the solid-phase polymerization processes as well as the conventional polytrimethylene terephthalate (PTT) produced by the prior art processes.

(I-2-ii) (Data showing the excellent effects)

The present invention exhibits the below-described excellent effects, as compared to the conventional melt polymerization processes and the solid-phase polymerization processes as well as the conventional polytrimethylene terephthalate (PPT) resin produced by the prior art processes.

The polytrimethylene terephthalate (PPT) resin of the present invention not only has a low cyclic dimer content but is also capable of suppressing the formation of the cyclic dimer even during the melt molding, thereby enabling the pro-

duction of an excellent shaped article stably on a commercial scale, the shaped article having advantages not only in that the shaped article has high strength and excellent color, but also in that the shaped article is free from the bleeding of the cyclic dimer to the surface of the shaped article, so as to be suitable for coating with a coating composition or adhesive agent and exhibit excellent adhesion property. By the method of claim 3 of the present application, the excellent polytrimethylene terephthalate (PPT) resin of the present invention can be produced stably with high productivity on a commercial scale.

Such excellent effects of the present invention are fully substantiated by Examples 1 to 24 and Comparative Examples 1 to 17 of the present specification. (Most important data of Examples 1 to 24 and Comparative Examples 1 to 17 are indicated in Tables 1 to 5 at pages 211 to 217 of the present specification.)

With reference to Examples 1 and 2 and Comparative Examples 1, 4 and 9 of the present specification, the Applicants have made observations to show that any of the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) and the "in a molten form" requirement of step (2) of the method of claim 3 of the present application, is critical for producing the polytrimethylene terephthalate resin of the present invention that satisfies all excellent features of

claim 1 of the present application. The method and results of the observations are as described in **Example 1** of the accompanying **Mr. Hiroshi YOKOYAMA Declaration**.

The gist of the observations of **Exhibit 1** is described below.

Especially, attention is drawn to **Examples 1 and 2** and **Comparative Examples 1, 4 and 9** of the present specification.

As described hereinbelow, a comparison between **Examples 1 and 2** and **Comparative Examples 1 and 4** clearly shows that the **cyclic dimer formation index (E)** requirement (i.e., less than 0.066) of step (1) of the method of claim 3 of the present application is critical for producing the excellent polytrimethylene terephthalate resin of the present invention.

As also described hereinbelow, a comparison between **Examples 1 and 2** and **Comparative Example 9** clearly shows that the polytrimethylene terephthalate resin of the present invention cannot be obtained by a solid-phase polymerization process that is a representative conventional technology (employed alone or in combination with a conventional melt polymerization process). In other words, the "in a molten form" requirement of step (2) of the method of claim 3 of the present application is critical for producing the excellent polytrimethylene terephthalate resin of the present invention.

The most important data of **Examples 1 and 2** and **Comparative Examples 1, 4 and 9** are indicated in Table 2 at pages 212

and 213 of the present specification. For easier reference, the data of Examples 1 and 2 and Comparative Examples 1, 4 and 9 (as in Table 2 of the present specification) are collected and shown in Tables A and B below. (The data collected from "Table 2 (to be continued)" at page 212 is indicated in Table A, and the data collected from "Table 2 (continued)" at page 213 is indicated in Table B.) It is important to note that the claims are not limited to any of the Examples shown or described.

Table A

	produc- tion of crude PTT resin	Properties of crude PTT resin (prepoly- mer)		Polymerization conditions					State of crude PTT resin in po- lymerizer	
		Intrin- sic vis- cosity [η]	\bar{X} value (cyclic dimer forma- tion index)	Mode of polymeri- zation (guide)	Tem- pera- ture (°C)	Pres- sure (Pa)	Nitro- gen (mg/g)	Foaming	Staining	
Example 1 (present invention)	Produc- tion Example 1	0.65	0.005	Wire (melt po- lymeriza- tion)	255	20	0	good	small	
Example 2 (present invention)	Produc- tion Example 2	0.71	0.016	Wire (melt po- lymeriza- tion)	255	20	0	good	small	
Comparative Example 1	Produc- tion Example 4	0.72	0.071	Wire (melt po- lymeriza- tion)	255	20	0	good	small	
Comparative Example 4	Produc- tion Example 8	1.02	0.071	Wire (melt po- lymeriza- tion)	250	150	0	good	small	
Comparative Bxample 9	Produc- tion Example 1	0.65	0.005	Solid- phase polymeri- zation	205	20	0	-	-	

Table B

	Properties of final PTT resin					
	Intrinsic viscosity [η]	Molecular weight distri- bution (Mw/Mn)	Cyclic dimer content (wt %)	Color		Crystallin- ity (%)
				b*	L*	
Example 1 (present invention)	1.10	2.2	1.50	1	88	5
Example 2 (present invention)	1.21	2.3	1.68	5	90	6
Comparative Example 1	1.18	2.3	2.45	7	88	5
Comparative Example 4	1.45	2.4	2.34	10	86	4
Comparative Example 9	0.78	3.0	1.01	2	88	55

As shown in Table A above, each of Examples 1 and 2 satisfies all requirements of the method of claim 3 of the present application.

On the other hand, as also shown in Table A, each of Comparative Examples 1 and 4 employs a crude PTT resin having an E value of 0.071; that is, Comparative Examples 1 and 4 do not satisfy the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) of the method of claim 3 of the present application.

Further, as also shown in Table A, Comparative Example 9 employs a *solid-phase* polymerization process; that is, Comparative Example 9 does not satisfy the "in a molten form" require-

Serial No. 10/539,054

ment of step (2) of the method of claim 3 of the present application.

(Evaluation of the results of Examples 1 and 2 and Comparative Examples 1, 4 and 9)

As indicated in Table B above, the results of Examples 1 and 2 (i.e. the properties of the PTT resins obtained) are excellent; specifically, the PTT resins obtained satisfy all requirements of claim 1 of the present application. The results of Examples 1 and 2 are described in the present specification as follows:

(Example 1)

"The obtained PTT resin had a high molecular weight, a narrow molecular weight distribution, a low cyclic dimer content, and excellent color."

(emphasis added) (see page 185, lines 7 to 9 of the present specification); and

(Example 2)

"In each of Examples 2 to 7, the obtained PTT resin (in the form of pellets) had a high molecular weight, a narrow molecular weight distribution, a low cyclic dimer content and excellent color."

(emphasis added) (see page 186, lines 16 to 19 of the present specification).

As also indicated in Table B above, the results of Comparative Examples 1 and 4 (i.e. the properties of the PTT resins obtained) are poor; specifically, the PTT resins obtained in Comparative Examples 1 and 4, respectively, exhibit cyclic dimer

Serial No. 10/539,054

contents (% by weight) of 2.45 and 2.34, which do not satisfy the cyclic dimer content (% by weight) requirement (not greater than 2 % by weight) of claim 1 of the present application. The results of Comparative Examples 1 and 4 are described in the present specification as follows:

" In Comparative Example 1, the crude PTT resin used as a prepolymer had a cyclic dimer formation index (E) as high as 0.071, and, hence, a PTT resin having a low cyclic dimer content could not be obtained.

.....

.....

.....

In Comparative Example 4, the crude PTT resin produced in Production Example 8 was used as a prepolymer, which crude PTT resin had a cyclic dimer content as low as 0.92 % by weight. However, the prepolymer had a cyclic dimer formation index (E) as high as 0.071, so that the cyclic dimer content of the final PTT resin could not be decreased and, on the contrary, was increased. "

(emphasis added) (see page 187, lines 3 to 6 and 17 to 24 of the present specification).

As also indicated in Table B above, the results of Comparative Example 9 (i.e. the properties of the PTT resin obtained) are poor; specifically, the PTT resin obtained exhibits a molecular weight distribution (Mw/Mn) of 3, which does not satisfy the molecular weight distribution (Mw/Mn) requirement (from 2 to 2.7) of claim 1 of the present application. Also the PTT resin obtained exhibits a crystallinity as high as 55 (which causes

Serial No. 10/539,054

high brittleness). The results of Comparative Example 9 are described in the present specification as follows:

" The obtained pellets were analyzed, and as a result, it was found that the obtained PTT resin had a high molecular weight, a low cyclic dimer content and good color. However, the PTT resin had a broad molecular weight distribution. Further, the pellets obtained by the solid-phase polymerization process not only had attached thereto polymer powder in an amount as large as 1 % by weight, but also had a crystallinity as high as 55 %, so that the obtained pellets were brittle. If it is attempted to transfer the obtained pellets by means of a feeder or a pneumatic conveyer, the pellets would be broken, thereby forming a large amount of polymer powder."

(emphasis added) (see page 194, line 16 to 195, line 3 of the present specification).

(Conclusion of the observations)

Thus, a comparison between Examples 1 and 2 and Comparative Examples 1 and 4 clearly shows that the polytrimethylene terephthalate resin of the present invention cannot be obtained when the crude PTT resin used does not satisfy the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) of the method of claim 3 of the present application. In other words, the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) of the method of claim 3 of the present application is critical for producing the polytrimethylene terephthalate resin of the present invention that

Serial No. 10/539,054

satisfies all excellent features of claim 1 of the present application.

Further, a comparison between Examples 1 and 2 and Comparative Example 9 clearly shows that the polytrimethylene terephthalate resin of the present invention cannot be obtained by a solid-phase polymerization process that is a representative conventional technology. In other words, the "in a molten form" requirement of step (2) of the method of claim 3 of the present application is critical for producing the polytrimethylene terephthalate resin of the present invention that satisfies all excellent features of claim 1 of the present application.

Also, the following should be noted. As shown in Table A above, the crude PTT resin (obtained in Production Example 1) used in Comparative Example 9 satisfies the requirements of step (1) of the method of claim 3. Especially, the crude PTT resin (obtained in Production Example 1) used in Comparative Example 9 has an E value of 0.005, which satisfies the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) of the method of claim 3 of the present application. Therefore, Comparative Example 9 also shows that, even in the case where there are satisfied the requirements of step (1) of the method of claim 3 (including the cyclic dimer formation index (E) re-

Serial No. 10/539,054

quirement (i.e., less than 0.066) of step (1) of the method of claim 3), the excellent PTT resin of the present invention cannot be obtained when the "in a molten form" requirement of step (2) of the method of claim 3 is not satisfied.

Thus, Examples 1 and 2 and Comparative Examples 1, 4 and 9 of the present specification clearly show that the polytrimethylene terephthalate resin of the present invention that satisfies all excellent features of claim 1 of the present application can be obtained only when there are satisfied both the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) and the "in a molten form" requirement of step (2) of the method of claim 3 of the present application.

Therefore, it is quite apparent that any of the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) and the "in a molten form" requirement of step (2) of the method of claim 3 of the present application, is critical for producing the polytrimethylene terephthalate resin of the present invention that satisfies all excellent features of claim 1 of the present application. Claim 1, however, is not restricted to any particular method.

Such excellent effects of the present invention are not taught or suggested by and are quite unexpected from any of the

Serial No. 10/539,054

prior art documents including the references cited in the office action.

Therefore, it is quite apparent that the present invention has non-obviousness over the disclosures of the prior art documents taken individually or in any combination.

/II/ With regard to the rejection of the claims

(II-1) (rejection under 35 USC § 112)

At page 3 of the office action, the Examiner states as follows:

" Where applicant acts as his or her own lexicographer to specifically define a term of a claim contrary to its ordinary meaning, the written description must clearly redefine the claim term and set forth the uncommon definition so as to put one reasonably skilled in the art on notice that the applicant intended to so redefine that claim term. *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1357, 52 USPQ2d 1029, 1033 (Fed. Cir. 1999). The term 'E' in claims 3 and 4 is used by the claims to mean 'a formation index for the terephthalate resin', while the accepted meaning is 'a rate of formation.' A rate is not a property of the compound rather it is a property of a process. Therefore the resin its self does not have a rate associated with it. The term is indefinite because the specification does not clearly redefine the term."

The Applicants wish to respond as follows.

The Examiner appears to have a misunderstanding about the cyclic dimer formation index E recited in claim 3.

Serial No. 10/539,054

The Applicants wish to respectfully point out that the Examiner's statement: "A rate is not a property of the compound rather it is a property of a process. Therefore the resin itself does not have a rate associated with it." is in error. This point is described below.

The cyclic dimer formation index E recited in claim 3 is defined by the following formula (3):

$$E = W/M \quad (3)$$

wherein M represents the terminal hydroxyl group content of said crude trimethylene terephthalate resin in terms of mole % based on the total molar amount of the trimethylene terephthalate unit, and W represents the re-formation rate of the cyclic dimer in terms of an increase (as expressed by absolute percentage value) in the cyclic dimer content (% by weight), per minute, of the crude trimethylene terephthalate resin as measured at 260 °C in nitrogen gas atmosphere with respect to a sample of the crude polytrimethylene terephthalate resin in a molten form, wherein the molten sample is obtained by melting a cyclic dimer-reduced sample of the crude polytrimethylene terephthalate resin which cyclic dimer-reduced sample has a cyclic dimer content reduced to 0.1 % by weight or less.

First of all, it should be noted that, with respect to the method for determining the cyclic dimer re-formation rate (W) (in the formula (3): $E = W/M$, recited in claim 3), the present specification has the following detailed description:

" The cyclic dimer re-formation rate (W) is a yardstick of the rate of formation of the cyclic dimer in the crude PTT resin. The cyclic dimer re-formation

Serial No. 10/539,054

rate (W) is determined as follows. A sample of the crude PTT resin is subjected to an extraction, for example, by means of a Soxhlet's extractor or the like, to thereby reduce the cyclic dimer content of the crude resin sample to 0.1 % by weight or less. Then, the resultant cyclic dimer-reduced sample is placed in a container, such as a glass ampule, and the container is purged with nitrogen. Then, the cyclic dimer-reduced sample in the container is heated at 260 °C so as to maintain the sample in a molten form for a pre-determined period of time, and the amount (% by weight, based on the weight of the sample) of the cyclic dimer re-formed during the melting of the sample is measured, and the obtained % by weight value is divided by the time (minutes) for which the sample has been maintained in a molten form, to thereby obtain the cyclic dimer re-formation rate (W). The time for maintaining the crude resin sample in a molten form is adjusted depending on the re-formation rate of the cyclic dimer, so that the cyclic dimer content of the crude resin sample after the heating for maintaining the crude resin sample in a molten form does not exceed 2 % by weight. The reason for this is as follows. When the cyclic dimer content of the crude resin sample is not greater than 2 % by weight, the amount of the cyclic dimer re-formed is proportional to the time for which the crude resin sample has been maintained in a molten form. That is, the cyclic dimer re-formation rate (W) is constant until the amount of the cyclic dimer content reaches 2 % by weight. However, when the cyclic dimer content of the crude resin exceeds 2 % by weight, the cyclic dimer re-formation rate (W) is gradually lowered in accordance with the increase in the cyclic dimer content."

(emphasis added) (see page 55, line 6 to page 56, line 17 of the present specification).

As seen from the above-quoted definition of the cyclic

Serial No. 10/539,054

dimer formation index E recited in claim 3, the W (re-formation rate of the cyclic dimer) (in the formula (3): $E = W/M$, recited in claim 3) is a value as determined by a method in which a cyclic dimer-reduced sample of the crude polytrimethylene terephthalate resin (which cyclic dimer-reduced sample has a cyclic dimer content reduced to 0.1 % by weight or less) is melted to thereby obtain a sample of the resin in a molten form, and the thus obtained sample in a molten form is maintained at 260 °C in nitrogen gas atmosphere and measured with respect to an increase (as expressed by absolute percentage value) in the cyclic dimer content (% by weight), per minute, of the crude trimethylene terephthalate resin.

Simply stated, the W (re-formation rate of the cyclic dimer) is one type of a value of change which is exhibited by a compound (i.e., the crude polytrimethylene terephthalate resin) when exposed to a specific energy. (In the present case, the specific energy is a thermal energy.) Other examples of such values include thermal decomposition properties, thermal crystallization properties and a tensile elongation at break.

The Examiner's attention is drawn to the fact that the U.S. Patent Laws permits a claim in which a compound is defined by a value of change which is exhibited by the compound when exposed

Serial No. 10/539,054

to a specific energy. Actually, there are various U.S. Patents having such claims in which a compound is defined by a value of change which is exhibited by the compound when exposed to a specific energy. As evidence supporting this contention of the Applicants, the Applicants hereby submit Exhibits 2 to 4. Exhibit 2 is a copy of the cover page and columns 31-32 of US 7,060,780 B2. Exhibit 3 is a copy of the cover page and columns 71-72/73-74 of US 6,852,806 B2. Exhibit 4 is a copy of the cover page and columns 15-16 of U.S. Patent No. 5,022,990. Attention is drawn to claim 6 of Exhibit 2, last paragraph of claim 1 of Exhibit 3, and last paragraph of claim 1 of Exhibit 4. More specifically, please see the following.

Claim 6 of Exhibit 2 (US 7,060,780 B2) states as follows:

"6. The molded article according to any one of claims 1 to 4, wherein when said alkali metal salt (C) of an organic sulfonic acid is subjected to thermogravimetric analysis at a temperature elevation rate of 10° C./min in a nitrogen atmosphere, the temperature at which the weight reduction of said alkali metal salt (C) reaches 5 % by weight is 400° C. or higher."
(emphasis added).

The last paragraph of claim 1 (directed to a hydrogenated copolymer) of Exhibit 3 (US 6,852,806 B2) states as follows:

"(5) substantially no crystallization peak observed at -50 to 100° C. in a differential scanning calorimetry (DSC) chart obtained with respect to said hydrogenated copolymer."

Serial No. 10/539,054

(emphasis added).

The last paragraph of claim 1 (directed to a porous membrane) of Exhibit 4 (U.S. Patent No. 5,022,990) states as follows:

"and said membrane having a uniform, three-dimensional, network pore structure, and a tensile strength at break of from 70 to 200 kg/cm², a tensile elongation at break of from 100 to 500 % and a porosity of from 40 to 90 %."

(emphasis added).

As apparent from the above, the U.S. Patent Law permits a claim in which a compound is defined by a value of change which is exhibited by the compound when exposed to a specific energy.

The W (re-formation rate of the cyclic dimer) (in the formula (3): $E = W/M$, recited in claim 3) is a value of change which is exhibited by a compound (i.e., a crude PTT resin) when exposed to a specific energy (i.e., a thermal energy).

Therefore, it is firmly believed that the cyclic dimer formation index E (defined by the formula (3): $E = W/M$) recited in claim 3 should be permitted under the U.S. Patent Law. The undersigned attempted to reach the Examiner to obtain clarification. However, the Examiner could not be reached. Perhaps the Examiner wishes for a letter other than "E" to be used to describe the property since the Examiner believes "E" has a known

Serial No. 10/539,054

meaning in the field. If the Examiner has continued questions regarding this property, the Examiner is requested to telephone the undersigned to address these questions.

The Applicants wish to respectfully, earnestly ask the Examiner to retract the rejection under 35 USC § 112.

(II-2) (rejection under 35 USC § 102)

(Page 3, line 4 from bottom et seqq. of the office action)

Claims 1 to 4 and 7 to 8 have been rejected under 35 USC 102(b) as being anticipated by Kato et al. (WO 99/11709) using US 6,423,814 as English translation) and further using "The Encyclopedia of Polymer Science and Technology" as evidence. More specifically, the Examiner states as follows:

Regarding claim 1: Kato teaches a polyester resin comprising 98 wt.% polytrimethylene terephthalate (PTT), 0.9 wt.% cyclic dimer and having an intrinsic viscosity of 1.1 dl/g and a b* value of 0.1 (**Table 1, Examples 1 and 8**). The mw distribution is not stated. However, the molecular weight of a polyester is related to the intrinsic viscosity by the Mark-Houwink equation (Encyclopedia of Polymer Science and Technology, page 548, equation (1)) therefore the resin would meet the molecular weight limitation since it meets the intrinsic viscosity limitation.

.....
.....
.....

Regarding claims 3 and 4: Kato teaches a method of producing a PTT resin comprising (1) providing a melt

Serial No. 10/539,054

phase resin, 260-280° C, (col. 8, lines 55-67 and col. 9, lines 1-5) having a purity of 98 wt.% poly-trimethylene terephthalate, 0.9 wt.% cyclic dimer and having an intrinsic viscosity of 1.1 dl/g (**Table 1, Examples 1 and 8**) and (2) Removing the cyclic dimer by 0.5 wt.% or more by volatilization under reduced pressure (col. 10, lines 45-55). Note that in **Table 1, Example 1** contains 2.4 % cyclic dimer and **Example 8**, derived from Example 1, contains only 0.9 % cyclic dimer, a drop of 1.5 %. The cyclic dimer formation rate, E, is an adjustable parameter depending on the reaction temperature (col. 9, lines 1-5)."
(emphasis by bold/italic added).

The Applicants wish to respond as follows.

Simply stated, the Examiner appears to consider that Examples 1 and 8 of Kato et al. disclose claims 1 and 3 of the present application.

Contrary to the Examiner's such position, the PTT resin (claim 1) and the method (claim 3) of the present invention have both novelty and non-obviousness over Kato et al. (US 6,423,814). This point is described below.

First, the following should be noted. The present inventors have for the first time found that, for producing a PTT resin which not only has a low cyclic dimer content but is also capable of suppressing the formation of the cyclic dimer even during the melt molding, thereby enabling the production of an excellent shaped article stably on a commercial scale, the shaped article having advantages not only in that the shaped article has

Serial No. 10/539,054

high strength and excellent color, but also in that the shaped article is free from the bleeding of the cyclic dimer to the surface of the shaped article, so as to be suitable for coating with a coating composition or adhesive agent and exhibit excellent adhesion property, it is critically important to first provide a crude PTT resin satisfying (the requirements of step (1) of the method of claim 3 of the present application, especially) the requirement that the crude PTT resin have a cyclic dimer formation index (E) of less than 0.066. This finding is based on the present inventors' detailed studies into, for example, the properties and formation mechanism of the cyclic dimer (see item (I-2-i) above). The present inventors have also for the first time found the methods for adjusting the cyclic dimer formation index (E) to a value less than 0.066. (These methods for adjusting the cyclic dimer formation index (E) to a value less than 0.066, are described in detail at page 59, line 14 to page 61, line 5 and page 120, line 8 to page 142, line 15 of the present specification.) Such methods for adjusting the cyclic dimer formation index (E) to a value less than 0.066, are not taught or suggested in any prior art documents including the cited references. Therefore, it is quite apparent that the method of Kato et al. does not satisfy the cyclic dimer formation index (E) re-

Serial No. 10/539,054

quirement (i.e., less than 0.066) of step (1) of the method of claim 3 of the present application.

Meanwhile, as mentioned above, in connection with claims 3 and 4 of the present application, the Examiner states as follows:

"The cyclic dimer formation rate, E, is an adjustable parameter depending on the reaction temperature (col. 9, lines 1-5)."

(emphasis added) (see page 5, lines 9 to 11 of the office action).

For easy reference, the Examiner's indicated portion (i.e., "col. 9, lines 1-5") of Kato et al. is quoted below:

"On the other hand, if the polymerization is performed at a temperature lower than 260° C., the amount of cyclic dimer increases. Accordingly, the reaction temperature is preferably selected by taking account of the balance between the reaction rate and the amount of cyclic dimer. The temperature is preferably from 260 to 280° C."

(see column 9, lines 1 to 6 of Kato et al.)

The gist of the above-quoted description of Kato et al. is considered to be as follows: "From the viewpoint of increasing the reaction rate and preventing an increase in the amount of cyclic dimer, the reaction temperature is preferably from 260 to 280° C."

Serial No. 10/539,054

The above-quoted description of Kato et al. shows that Kato et al. are motivated to choose a reaction temperature of from 260 to 280° C. The teaching of the above-quoted description of Kato et al. has nothing to do with the property E. As mentioned above, E is related to a specific testing preceding. It is improper to manipulate to procedure to arrive at a desired E value.

Aside from whether such teaching of Kato et al. is right or not, such teaching of Kato et al. has no relevancy to the essential features of claims 1 and 3 of the present application (especially the cyclic dimer formation index (E) requirement of step (1) of the method of claim 3).

Next, the following should be noted. Attention is drawn to the fact that, in Example 8 of Kato et al., a crude PTT resin (obtained by a conventional melt polymerization process effected in Example 1 of Kato et al.) is subjected to a solid phase polymerization process. This, is clearly shown in the following descriptions of Examples 1 and 8 of Kato et al.:

EXAMPLE 1

To a reactor, 25,000 parts of dimethyl terephthalate (hereinafter simply referred to as 'DMT'), 21,553 parts by weight of trimethylene glycol and 0.1 wt %/DMT (this unit indicates wt % based on DMT) of a 7:1 mixture containing calcium acetate and cobalt acetate tetrahydrate were charged and then subjected to

Serial No. 10/539,054

ester exchange reaction under heating at a heater temperature of 240° C. for 4 hours under normal pressure. "

(emphasis added) (see column 12, lines 58 to 66 of Kato et al.); and

" EXAMPLE 8

The resin composition of Example 1 was subjected to solid phase polymerization at 215° C. for 5 hours in a nitrogen stream. The physical properties of the resin composition obtained are shown in Table 1. In this resin composition, the amount of cyclic dimer was greatly reduced. Furthermore, by virtue of increase in the viscosity, the fiber obtained had high tenacity."

(emphasis added) (see column 14, lines 8 to 16 of Kato et al.).

(In view of such relationship between Examples 1 and 8 of Kato et al., for convenience sake, Examples 1 and 8 of Kato et al. will be hereinafter discussed with reference mainly to Example 8 of Kato et al.)

In this connection, it should be noted that such Example 8 of Kato et al. (employing a solid-phase polymerization process) does not satisfy the "in a molten form" requirement of step (2) of the method of claim 3 of the present application.

Thus, it is apparent that Example 8 of Kato et al. does not satisfy any of the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) and the "in a molten form" requirement of step (2) of the method of claim 3 of the present

Serial No. 10/539,054

application.

Therefore, it is quite apparent that the method of claim 3 of the present application has **novelty** over **Example 8** of Kato et al.

In this connection, attention is drawn to the fact that, as described in item (I-2-ii) above with reference to **Exhibit 1** of Mr. Yokoyama Declaration, any of the cyclic dimer formation index (E) requirement (i.e., less than 0.066) of step (1) and the "in a molten form" requirement of step (2) of the method of claim 3 of the present application, is critical for producing the polytrimethylene terephthalate resin of the present invention that satisfies all excellent features of claim 1 of the present application.

Therefore, it is quite apparent that the method of claim 3 of the present application has both **novelty** and **non-obviousness** over **Example 8** of Kato et al.

In addition, it is also apparent that the polytrimethylene terephthalate resin of the present invention that satisfies all excellent features of claim 1 of the present application, cannot be obtained based on **Example 8** of Kato et al.

Therefore, it is apparent that the polytrimethylene terephthalate resin of claim 1 of the present application has

Serial No. 10/539,054

both *novelty and non-obviousness* over **Example 8** of Kato et al.

Further, it should also be noted that such **Example 8** of Kato et al. (employing a *solid-phase* polymerization process) is substantially *equivalent* to (the above-described) **Comparative Example 9** of the present specification (see item (I-2-ii) above). As described in item (I-2-ii) above, **Comparative Example 9** of the present specification employs a *solid-phase* polymerization process.

Therefore, it is believed that, just as in the case of **Comparative Example 9** of the present specification, the PTT resin obtained in **Example 8** of Kato et al. exhibits a molecular weight distribution (Mw/Mn) as broad as 3, which does not satisfy the molecular weight distribution (Mw/Mn) requirement (from 2 to 2.7) of **claim 1** of the present application. The Examiner's molecular weight distribution allegation is not correct.

Further, attention is drawn again to, for example, the following description of the present specification (concerning the defects of a *solid-phase* polymerization process):

"Further, as mentioned above, as a result of the studies of the present inventors, it has been found that, even when a PTT having its *cyclic dimer content* reduced to less than 1 % by weight is produced by the *solid-phase* polymerization process, the cyclic dimer is rapidly produced upon melting thereof during the

Serial No. 10/539,054

melt-molding of the PTT, and the reduced cyclic dimer content of the PTT returns to the cyclic dimer content (about 2.5 to 3.5 % by weight) of the prepolymer prior to the solid-phase polymerization in which the hydroxyl group-containing terminal portions are at the ring-linear chain equilibrium state."

(emphasis added) (see page 47, line 19 to page 48, line 6 of the present specification).

That is, the solid-phase polymerization process poses a serious problem in that, even when a PTT resin having its cyclic dimer content reduced to less than 1 % by weight is produced by the solid-phase polymerization process, the cyclic dimer is rapidly produced upon melting of the PTT resin during the melt-molding thereof, and the reduced cyclic dimer content of the PTT resin returns to the cyclic dimer content (about 2.5 to 3.5 % by weight).

Therefore, although a cyclic dimer content of only "0.9 wt.%" is exhibited by the TPP resin obtained in Example 8 of Kato et al., when the TPP resin is melted, the cyclic dimer content of "0.9 wt.%" will rapidly return to the original value (2.4 wt.%) exhibited in Example 1 of Kato et al.

By contrast, the PTT resin of the present invention not only has a low cyclic dimer content but is also capable of suppressing the formation of the cyclic dimer even during the melt molding.

Serial No. 10/539,054

As apparent from the above, the polytrimethylene terephthalate resin of the present invention that satisfies all excellent features of claim 1 of the present application cannot be obtained by the method of Kato et al.

Furthermore, it should be noted that, in the Kato et al. reference, the *solid-phase* polymerization technique (used in Example 8 of Kato et al.) is recognized as very *important*. This is apparent from, for example, the following description of Kato et al.:

"To attain an intrinsic viscosity of 0.81 or more, a method of using *solid phase* polymerization is preferably used. The *solid phase* polymerization is advantageous in that the intrinsic viscosity can be elevated and also in that the cyclic dimer escapes from the resin composition during the *solid phase* polymerization because the cyclic dimer has sublimability, and thereby the amount of cyclic dimer can be reduced to 2 wt % or less, preferably 1 wt % or less.

.....
....."

(emphasis added) (see column 10, lines 40 to 59 of Kato et al.)

Thus, it is apparent that Example 8 of Kato et al. (employing a *solid-phase* polymerization process) is a most preferred embodiment (giving optimal results) of Kato et al.

Therefore, in view of the fact that the present invention

Serial No. 10/539,054
is *superior* to Example 8 of Kato et al., it is quite apparent
that the present invention is *superior* to any of all embodiments
of Kato et al.

As apparent from the above, any of claims 1 and 3 of the
present application has both novelty and non-obviousness over
the disclosure of Kato et al.

It is believed that the rejection of claims 1 to 4 and 7
and 8 over Kato et al. has been removed by the above data and
arguments.

(II-3) (rejection under 35 USC § 103)

(Page 5, line 8 from bottom et seqq. of the office action)

Claims 5 and 6 have been rejected under 35 USC 103(a) as
being unpatentable over by Kato et al. (WO 99/11709) as applied
to claims 1 to 4 and 7 and 8 above, and further in view of Oka-
jima et al. (US 2003/0092874).

The Applicants wish to respond as follows.

Claims 5 and 6 directly or indirectly depend from claim 3.

It is believed that the patentability of claim 3 has been
established.

Therefore, it is also believed that the rejection of claims
5 and 6 has been removed.

Conclusion

Thus, it is believed that all rejections and objections

Serial No. 10/539,054

have been removed, and the present application is now in condition for allowance.

Reconsideration and early favorable action on the claims are earnestly solicited.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited. Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: Feb 29, 2008By: Mark J. Henry
Mark J. Henry
Registration No. 36,162

1201 New York Avenue, N.W., 7th Floor
Washington, D.C. 20005
Telephone: (202) 434-1500
Facsimile: (202) 434-1501